

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number  
**WO 2004/047258 A3**

(51) International Patent Classification<sup>7</sup>:  
41/03, H02P 6/06, H02K 7/116

H02K 21/24,

(72) Inventor; and

(75) Inventor/Applicant (for US only): TAKEUCHI, Ke-  
satoshi [JP/JP]; c/o SEIKO EPSON CORPORATION,  
3-5, Owa 3-chome, Suwa-shi, Nagano 392-8502 (JP).

(21) International Application Number:

PCT/JP2003/014667

(22) International Filing Date:

18 November 2003 (18.11.2003)

(74) Agents: INABA, Yoshiyuki et al.; TMI ASSOCIATES,  
23rd Floor, Roppongi Hills Mori Tower, 6-10-1, Roppongi,  
Minato-ku, Tokyo 106-6123 (JP).

(25) Filing Language:

English

(81) Designated States (national): CN, JP, KR, US.

(26) Publication Language:

English

(84) Designated States (regional): European patent (AT, BE,  
BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU,  
IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR).

(30) Priority Data:

2002-334160	18 November 2002 (18.11.2002)	JP
2003-157229	2 June 2003 (02.06.2003)	JP
2003-175456	19 June 2003 (19.06.2003)	JP
2003-313170	4 September 2003 (04.09.2003)	JP

Published:

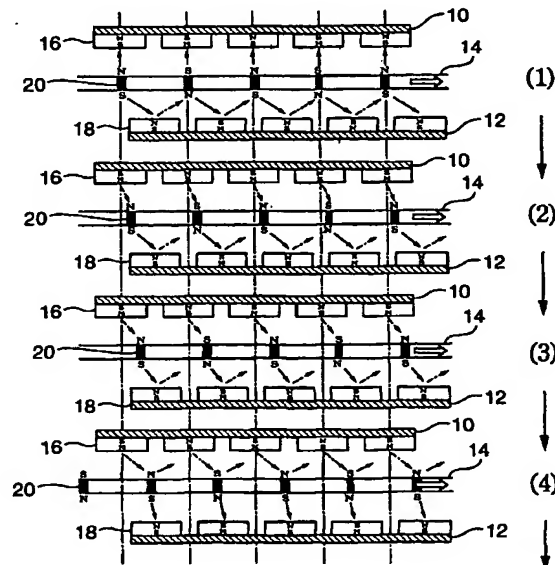
— with international search report

(88) Date of publication of the international search report:  
24 March 2005

(71) Applicant (for all designated States except US): SEIKO  
EPSON CORPORATION [JP/JP]; 4-1, Nishishinjuku  
2-chome, Shinjuku-ku, Tokyo 163-0811 (JP).

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: MAGNETIC STRUCTURE AND MOTOR EMPLOYING SAID MAGNETIC STRUCTURE, AND DRIVER COM-  
PRISING SAID MOTOR



(57) Abstract: Provided is a small motor superior in weight/torque balance. A phase stator 10 and B phase stator 12 are disposed to face each other. A rotor is interpositioned between these stators. Electromagnetic coils @ are provided to the stators evenly in the circumferential direction. A permanent magnet is provided to the rotor evenly in the circumferential direction. The exciting polarity of the electromagnetic coil is alternately opposite, and this is the same for the permanent magnet. A signal having a prescribed frequency is input to the A phase electromagnetic coil and B phase electromagnetic coil. The rotor rotates between the stators as a result thereof.

WO 2004/047258 A3

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference  S0279SW10WO	<b>FOR FURTHER ACTION</b> <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No.  PCT/JP 03/14667	International filing date (day/month/year)  18/11/2003	(Earliest) Priority Date (day/month/year)  18/11/2002
Applicant  SEIKO EPSON CORPORATION		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 9 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☒ **Certain claims were found unsearchable** (See Box I).

3. ☒ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established; according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP 03/14667

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☒ Claims Nos.: 19-22, 24-26  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
  
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
  
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
  
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 19-22, 24-26

The wording of the independent claims 19, 21 and 24 is so obscure and incoherent and leads to such a lack of clarity in the sense of Article 6 PCT that a meaningful search over the whole claimed scope is impossible. Consequently, the search has not been carried out for the above mentioned claims.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8,13,15,16,17,27,28,31,33,38,39

Magnetic Structure with a bodies formed in straight lines  
---

2. claims: 9-12,23

Magnetic structure with rotational speed detection means  
---

3. claims: 14,18

Motor having a gear formed on the rotor  
---

4. claims: 29,30,32,34,35,36,37

Magnetic structure built according to the embodiment of fig.  
28  
---

## INTERNATIONAL SEARCH REPORT

International Application No

JP 03/14667

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 H02K21/24 H02K41/03 H02P6/06 H02K7/116

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 H02K H02P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 497 317 A (FINEA D O O) 5 August 1992 (1992-08-05)	1-5, 8, 15, 17, 27, 28
Y	column 4, line 7 - line 9; claim 1; figures 1-4	9-12, 14, 18, 23
X	US 6 437 529 B1 (BROWN FRED A) 20 August 2002 (2002-08-20) column 2, line 49 - line 60; figures 2A, 2B, 3 column 3, line 7 - line 16; figure 5	1-5, 8, 17
X	US 6 011 337 A (WANG YU-YEN ET AL) 4 January 2000 (2000-01-04)  column 3, line 41 - line 55; claim 1; figures 1-3 figures 5-8	1, 5, 7, 8, 15, 31, 33, 38, 39
	----- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*8\* document member of the same patent family

Date of the actual completion of the international search

17 December 2004

Date of mailing of the international search report

- 3. JAN. 2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Roy, C

## INTERNATIONAL SEARCH REPORT

International Application No

JP 03/14667

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 751 089 A (STRIDSBERG LENNART) 12 May 1998 (1998-05-12) column 9, line 14 - line 16; figures 1A,1B column 8, line 15 - line 16; figures 10,11 figures 9C,9D	1,5-8, 13,15-17
X	US 5 218 251 A (ALLWINE JR ELMER C) 8 June 1993 (1993-06-08) figures 6-12	1-5,7,8, 15,38,39
X	US 4 870 306 A (PETERSEN CHRISTIAN C) 26 September 1989 (1989-09-26) claim 1; figure 1	1,6-8,15
X	EP 0 216 998 A (HUBNER ELEKTROMASCHINEN AG) 8 April 1987 (1987-04-08) figures 1-3	1,5,7,8, 17
A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 036 (E-158), 15 February 1983 (1983-02-15) -& JP 57 189559 A (YOSHITERU TAKAHASHI), 20 November 1982 (1982-11-20) abstract	6
A	US 4 187 441 A (ONEY WILFORD R) 5 February 1980 (1980-02-05) claim 1; figure 1	16
A	US 6 373 160 B1 (SCHROEDL MANFRED) 16 April 2002 (2002-04-16) figures 1-5	16
A	BOLDEA I ET AL: "Linear electric actuators and generators" 1997, ELECTRIC MACHINES AND DRIVES CONFERENCE RECORD, 1997. IEEE INTERNATIONAL MILWAUKEE, WI, USA 18-21 MAY 1997, NEW YORK, NY, USA,IEEE, US, PAGE(S) MA1-11-MA1-15, XP010231716 ISBN: 0-7803-3946-0 paragraph '00II!	5,6
Y	US 6 433 496 B1 (KAWAGOSHI HIROKAZU) 13 August 2002 (2002-08-13) column 6, line 4 - line 21; claims 1,3; figures 1,2	9-12
Y	EP 0 558 261 A (SGS THOMSON MICROELECTRONICS) 1 September 1993 (1993-09-01) column 1, line 20 - line 45; figures 1,2 column 5, line 49 - column 6, line 34; figure 3	9-12,23
	-/--	

## INTERNATIONAL SEARCH REPORT

International Application No.

JP 03/14667

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/113501 A1 (DOI HIROFUMI) 22 August 2002 (2002-08-22) figure 4	14, 18
Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 10, 31 October 1997 (1997-10-31) -& JP 09 158994 A (YASKAWA ELECTRIC CORP), 17 June 1997 (1997-06-17) abstract	14, 18
Y	DE 296 22 874 U (BERGER LAHR GMBH) 17 July 1997 (1997-07-17) figure 1	14, 18
X	GB 2 079 068 A (KELLY H P G) 13 January 1982 (1982-01-13) figures 1,3	29, 30, 32, 34-37
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 092 (E-491), 24 March 1987 (1987-03-24) -& JP 61 244250 A (FANUC LTD), 30 October 1986 (1986-10-30) abstract	29, 30, 32, 34-37
X	EP 0 431 178 A (NAKANO KAZUO) 12 June 1991 (1991-06-12) figures 4,5	29, 30, 32, 34-37
X	FR 2 606 951 A (ALSTHOM CGEE) 20 May 1988 (1988-05-20) figures 1-5	1, 29, 30, 32, 34-37
X	WO 96/29774 A (KENETECH WINDPOWER INC) 26 September 1996 (1996-09-26) figure 5	1, 29, 30, 32, 34-37

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

JP 03/14667

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0497317	A	05-08-1992	AT 111658 T DE 59200478 D1 EP 0497317 A1	15-09-1994 20-10-1994 05-08-1992
US 6437529	B1	20-08-2002	EP 1078442 A1 WO 9957795 A1	28-02-2001 11-11-1999
US 6011337	A	04-01-2000	DE 29816561 U1	17-12-1998
US 5751089	A	12-05-1998	AU 3466893 A DE 69309444 D1 DE 69309444 T2 EP 0624286 A1 JP 7503598 T WO 9315547 A1	01-09-1993 07-05-1997 02-10-1997 17-11-1994 13-04-1995 05-08-1993
US 5218251	A	08-06-1993	US 5258735 A AU 4116393 A US 5369323 A WO 9322822 A1 CA 2120764 A1 EP 0614571 A1 JP 7507420 T WO 9309550 A1 US 5691683 A US 5440185 A US 5313159 A	02-11-1993 29-11-1993 29-11-1994 11-11-1993 13-05-1993 14-09-1994 10-08-1995 13-05-1993 25-11-1997 08-08-1995 17-05-1994
US 4870306	A	26-09-1989	NONE	
EP 0216998	A	08-04-1987	DE 3530614 A1 EP 0216998 A1	05-03-1987 08-04-1987
JP 57189559	A	20-11-1982	NONE	
US 4187441	A	05-02-1980	NONE	
US 6373160	B1	16-04-2002	AT 408045 B AT 18898 A WO 9939426 A1 AT 253782 T AU 2142599 A CA 2319415 A1 DE 59907626 D1 EP 1051797 A1 SI 1051797 T1	27-08-2001 15-12-2000 05-08-1999 15-11-2003 16-08-1999 05-08-1999 11-12-2003 15-11-2000 30-04-2004
US 6433496	B1	13-08-2002	JP 10243678 A CN 1195223 A , B	11-09-1998 07-10-1998
EP 0558261	A	01-09-1993	US 5223772 A DE 69310574 D1 DE 69310574 T2 EP 0558261 A1 JP 6086584 A	29-06-1993 19-06-1997 11-09-1997 01-09-1993 25-03-1994
US 2002113501	A1	22-08-2002	JP 2002252963 A DE 10153727 A1	06-09-2002 12-09-2002

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

JP 03/14667

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 09158994	A	17-06-1997	NONE	
DE 29622874	U	17-07-1997	DE 29622874 U1	17-07-1997
GB 2079068	A	13-01-1982	AT 18967 T	15-04-1986
			AU 546740 B2	19-09-1985
			AU 7080181 A	26-11-1981
			BR 8103086 A	09-02-1982
			CA 1159502 A1	27-12-1983
			DE 3174230 D1	07-05-1986
			DK 217781 A ,B,	20-11-1981
			EP 0040509 A1	25-11-1981
			ES 8204249 A1	16-07-1982
			IE 52195 B1	05-08-1987
			JP 1825545 C	28-02-1994
			JP 5034902 B	25-05-1993
			JP 57052369 A	27-03-1982
			US 4460855 A	17-07-1984
			ZA 8103316 A	26-05-1982
JP 61244250	A	30-10-1986	NONE	
EP 0431178	A	12-06-1991	BR 9006786 A	13-08-1991
			DE 69019315 D1	14-06-1995
			DE 69019315 T2	21-09-1995
			EP 0431178 A1	12-06-1991
			KR 246655 B1	15-03-2000
			NO 910367 A	31-01-1991
			RU 2069441 C1	20-11-1996
			AT 122507 T	15-05-1995
			AU 645498 B2	20-01-1994
			AU 5720390 A	07-01-1991
			CA 2033170 A1	02-12-1990
			CN 1048129 A ,B	26-12-1990
			DK 431178 T3	10-07-1995
			ES 2072437 T3	16-07-1995
			WO 9015467 A1	13-12-1990
FR 2606951	A	20-05-1988	FR 2606951 A1	20-05-1988
WO 9629774	A	26-09-1996	AU 5258596 A	08-10-1996
			CA 2215971 A1	26-09-1996
			CN 1214809 A	21-04-1999
			EP 0815633 A1	07-01-1998
			JP 11511948 T	12-10-1999
			NO 974345 A	19-11-1997
			WO 9629774 A1	26-09-1996